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NASA TECH BRIEF

Marshall Space Flight Center

Nondestructive Testing of Railroad Wheels and Rails by Ultrasonics

The problem:

Many train wheels and rails cannot withstand stresses from very high-speed trains. Therefore, modern trains designed to travel at speeds of up to 150 mph (240 km/h) must be run at slower speeds. The heat developed during emergency braking at high speeds can damage the train wheels. Rails have a different problem. Modern rails are laid in long sections that are welded together to provide a more comfortable ride. Because they are long, temperature stresses during hot and cold weather make the sections structurally weak.

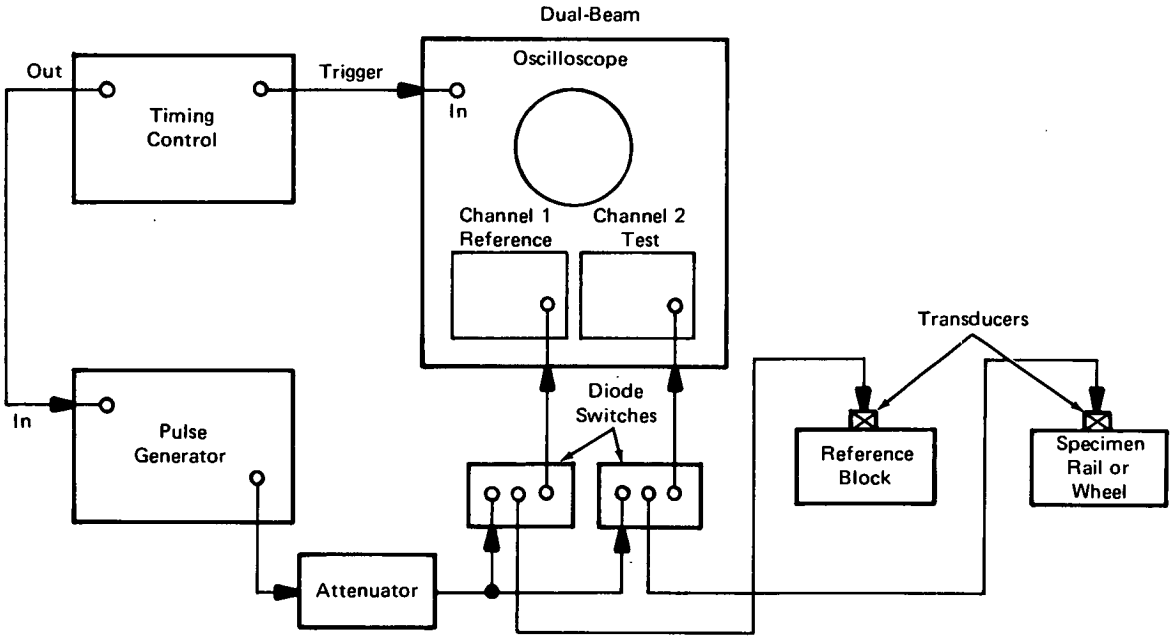
The solution:

Quality control of wheels and rails can be improved by using an ultrasonic technique developed for measuring stresses in metallic materials. In addition, parts already in use can be tested and replaced if they are found to be unsafe.

How it's done:

The technique is based on the measurement of the time it takes for an ultrasonic wave to propagate through a stressed part. This time is compared with a reference time, i.e., the time it takes the wave to move through an unstressed reference block. The difference between the times is directly proportional to the measured stress.

The test equipment, as illustrated, includes two transducers. One transducer is applied to the test specimen, and the other is applied to a reference block.



Block Diagram of Ultrasonic Stress Measurement Equipment

(continued overleaf)

One pulse-generator energizes both transducers. Each transducer is connected to a separate channel on the oscilloscope which is synchronized to the pulse generator.

The reflected ultrasonic pulses picked up by each transducer are traced by separate beams. The time difference between the pulse arrivals is measured directly on the oscilloscope using the delay-time multiplier control. The control is turned until the pulse peaks of the two beams coincide. The time indicated is the actual time difference between the two pulses, and this difference is directly proportional to the applied stress.

Note:

Requests for further information may be directed to:

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Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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